

SOIL ATTRIBUTES

SOIL is a dynamic living ecosystem. Complex chemical and biological reactions constantly occur. It provides nutrients, air, water and physical support for plants. Healthy soil is the foundation of a successful vegetable garden.

- Research shows 80% of plant problems are related to soil conditions, so...
- Gardeners benefit from understanding soil's physical properties and functions
- Soil must be effectively managed to grow healthy, resilient, productive plants.

TILTH is the suitability of soil to support plant growth. In your garden it's the soil's physical condition related to:

- ease of tillage
- fitness of the seedbed
- ease of seedling emergence and root penetration

Tilth is a function of texture, structure, fertility, and interplay of organic matter and living soil organisms.

TEXTURE is the size of the particles that make up a soil. It is determined by the proportion of sand, silt and clay particles (coarse to fine). Loamy soil has a roughly equal influence of sand, silt and clay-sized particles. Colorado soils are dominated by clays, sand and decomposed granite. Clay soils predominate in Grand County community gardens.

Clay: Pro - nutrient rich, retains moisture

Con - slow to drain, compacts easily, slow to warm in spring

STRUCTURE is how soil particles fit together. It creates pore or empty spaces for air and water circulation. Well-managed soil has 25% pores for air and 25% pores for water. Roots only grow with adequate levels of soil oxygen.

Peds are clusters (clumps) of soil particles of different sizes. A vegetable garden seedbed should have small (pea-size) peds.

Compaction is pressure that squeezes soil particles together thus reducing pore size. It is a major concern/problem with clay soils.

Soil with good structure is loose and crumbly - can push finger into the soil.

FERTILITY is the presence of nutrients or the 17 basic chemical elements needed for plant growth. Carbon, hydrogen, and oxygen come from air and water. Soil provides the other 14 elements. Roots take up nutrients as ions dissolved in soil's water.

Primary nutrients - nitrogen, phosphorus, potassium

Secondary nutrients - calcium, magnesium, sulfur

Micronutrients - iron, zinc, molybdenum, manganese, boron, copper, cobalt and chlorine

PH is a measurement of the acidity or alkalinity of a soil. It affects the availability of nutrients to plants and the activity of soil microorganisms. On the pH scale (0-14) 7.0 is neutral. Below 7 is acid and above 7 is basic or alkaline. A pH range of 6.0 to 7.5 is acceptable for most plants.

In Colorado, because of limited rainfall, the majority of soils are on the alkaline side, having a pH of 7.0 to 7.8 and above. Soils above 7.5 generally have high calcium carbonate known as free lime. The pH cannot be effectively lowered on soils with free lime.

PH moves toward neutral or slightly acid in older gardens that have been highly irrigated and cultivated with added organic matter for many years.

PH is best determined by a soils test. In alkaline soils, home pH tests have questionable value. Avoid trying to make drastic changes in soil pH.

ORGANIC MATTER is any material originating from a living organism (plant, animal and soil organisms) in various stages of decomposition. It makes up roughly 1-5% of a soil's volume. It includes four categories:

- living roots and organisms (<5%)
- residues of dead plants, animals, organisms not yet decomposing (<10%)
- residues undergoing rapid decomposition (20-45%)
- stabilized organic matter (humus) (50-80%) - most important

Primary functions of organic matter:

- food source for living soil organisms
- improves physical and chemical properties of soil

Colorado soils are naturally low in organic matter. Best to amend annually.

SOIL ORGANISMS. Soil naturally contains an enormous and diverse number of living organisms. They are nature's primary recyclers turning dead cells and tissues into nutrients, energy, carbon dioxide and water to support plant life. They function within an ecological food web where smaller organisms are food for larger organisms. Soil organisms include (small to large):

- bacteria
- fungi
- protozoa
- nematodes
- arthropods (insects, spiders, mites)
- earthworms

Soil structure (pore space) is also improved by the organic matter decomposed by soil organisms.

Soil organisms are most active when soil is warm (70-100 degrees) and moist.

Best to nurture existing communities of soil organisms by annually adding organic matter rather than introducing external organisms, such as rhizobia and mycorrhizae, through purchased products.

Earthworms. Those common in Colorado soils burrow deep in the mineral layers to survive winter. Purchased "compost" worms live on the soil's surface so are usually killed when the ground freezes. Best to find and transplant local worms. Earthworms:

- Aid in soil fertility and structure
- Contribute to overall plant health
- Worm castings (excrement) are high in nutrients
- Prefer soil temperatures between 40-70 degrees.
- Need moist, but not waterlogged, soils